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(56) Documents Cited
GB 2266075 A GB 1326671 A EP 0593172 A
EP 0523704 A

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(54) Airbag arrangement for protecting against side impact

(57) The air-bag arrangement is inflated by a gas generator (3) which supplies gas to a first air-bag (11). This air-bag is located between the torso of a person sitting in the motor vehicle and the side of the motor vehicle. The first air-bag (11) communicates by means of an airflow passage (8) to a second air-bag (9) located on top of the first air-bag (11). The second air-bag thus inflates after the first air-bag (11) is inflated and is positioned to provide protection for the head of a person sitting in the motor vehicle. The two air-bags may be formed as an integral air-bag structure and may be stored within the B-Post of the vehicle or the back of the seat.

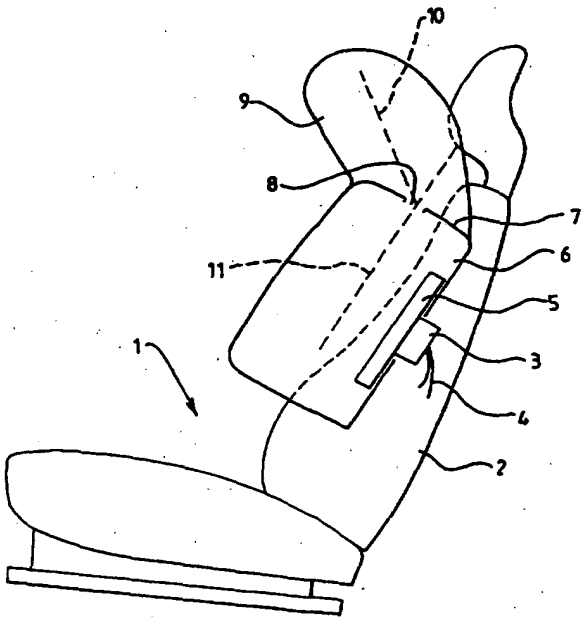

FIG 1

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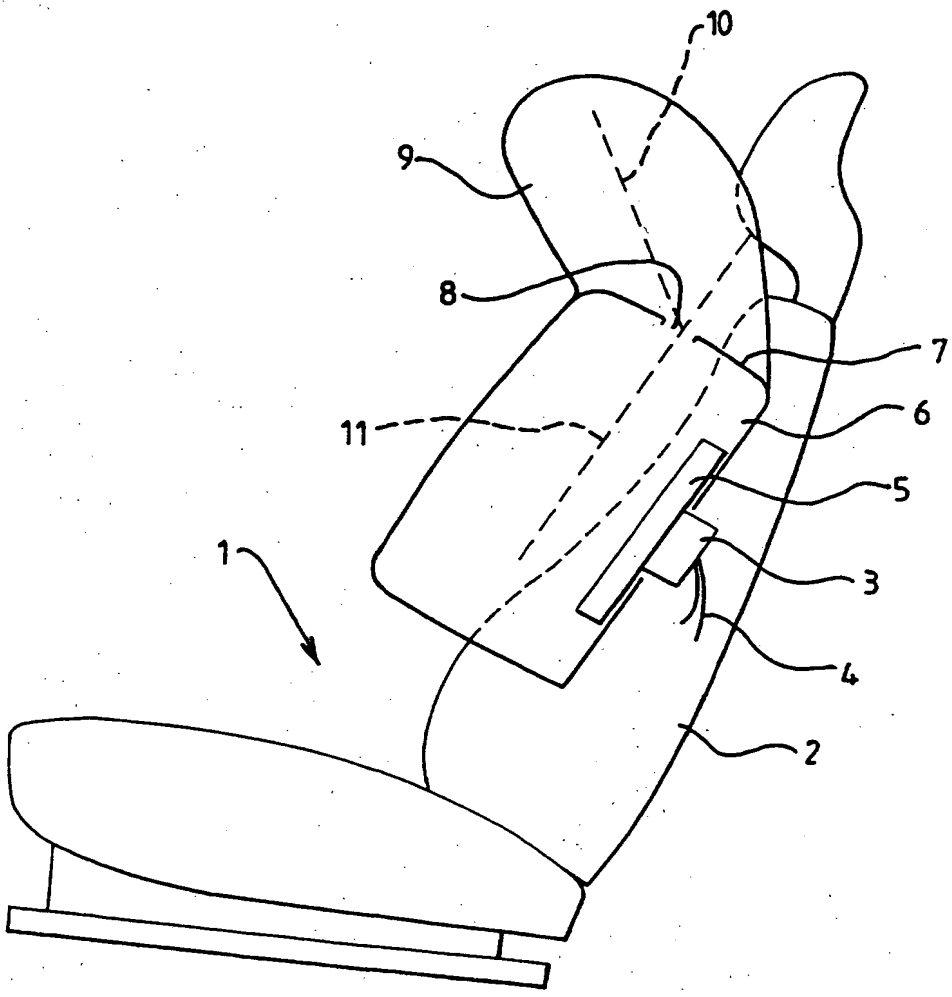

FIG 1

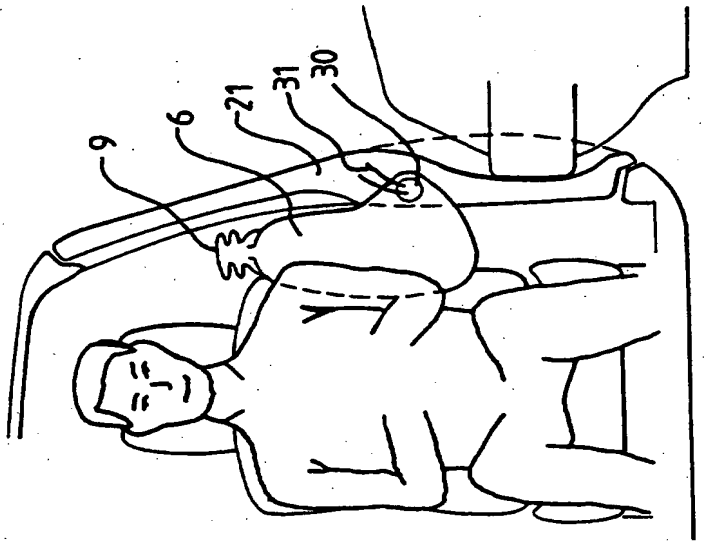

FIG 4

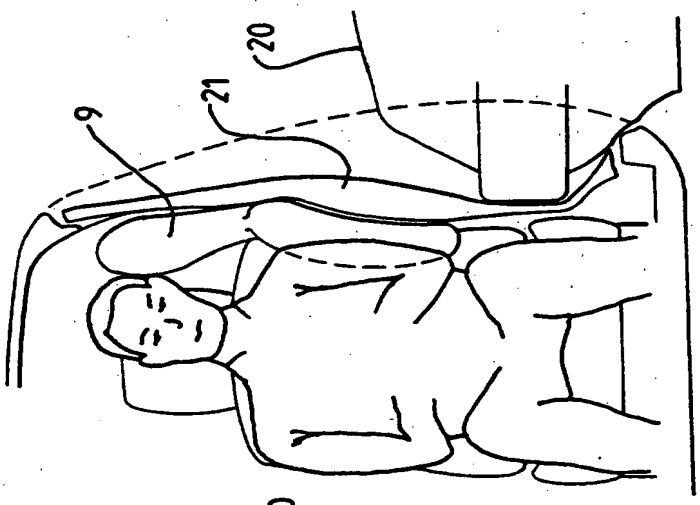

FIG 3

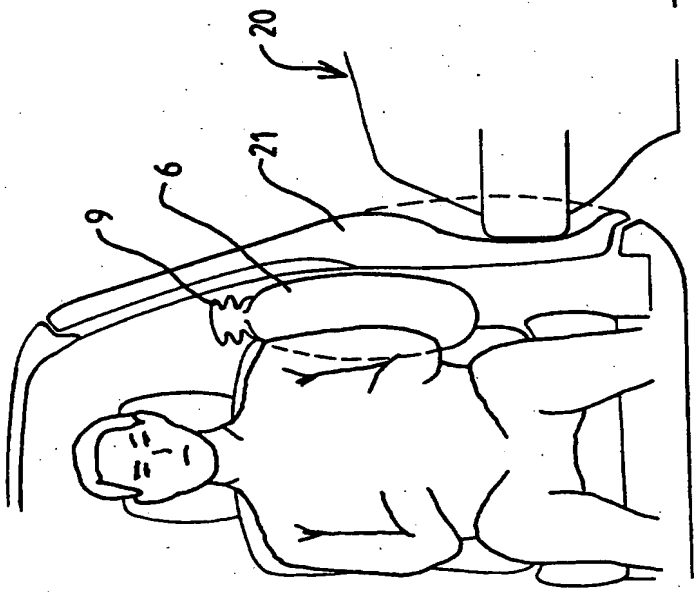

FIG 2

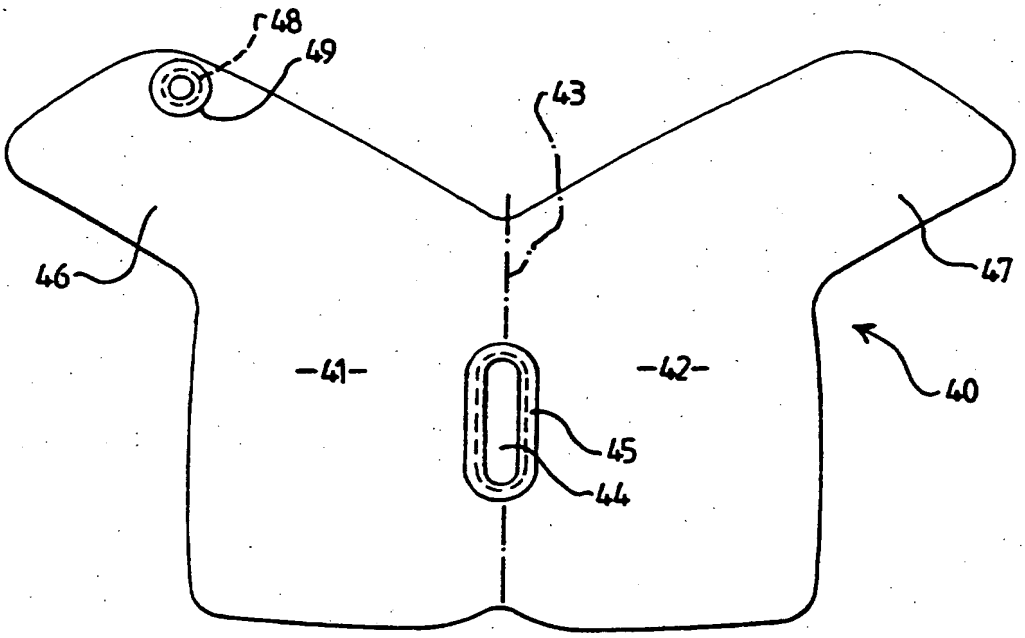

FIG 5

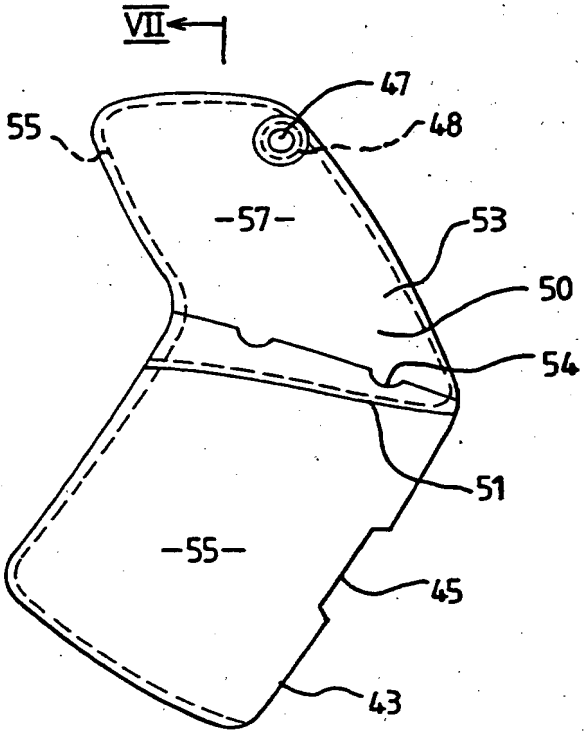

FIG 6

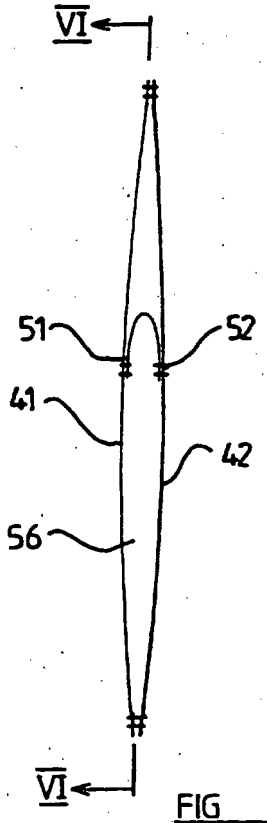

FIG 7

2299061

PATENTS ACT 1977
P9676GB-NF/jsd

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A SAFETY ARRANGEMENT"

THE PRESENT INVENTION relates to a safety arrangement, and more particularly relates to a safety arrangement for use in a motor vehicle.

It has been proposed to provide air-bags in a motor vehicle specifically located to protect the occupant of the vehicle should a side-impact occur. The present invention seeks to provide an improved safety arrangement of this type.

According to this invention there is provided a safety arrangement in a motor vehicle, the safety arrangement comprising a gas generator adapted to be activated in response to a side impact, the gas generator being adapted to supply gas to a first air-bag, the first air-bag, when inflated, being positioned and adapted to be located between a side of the motor vehicle and the torso of an occupant of the motor vehicle, a second air-bag being connected to the first air-bag and communicating with the interior of the first air-bag by means of one or more relatively small airflow passages, the second air-bag being adapted to be inflated by gas from the first air-bag, the second air-bag, when inflated, being adapted to be located between the head of an occupant of a motor vehicle and the side of the vehicle.

In one embodiment the first and second air-bag are not vented to the atmosphere.

In an alternative embodiment the combination of the first and second air-bag are vented to the atmosphere.

Preferably only the second air-bag is vented to the atmosphere.

Preferably a common wall forms part of each of the two air-bags, the said one or more airflow passages being constituted by one or more apertures formed in the common wall, the common wall being larger than the aperture or apertures.

Conveniently the said one or more airflow passages have a total cross-section of between 200 and 800 mm^2, preferably approximately 500 mm^2.

Conveniently the volume of the first air-bag is between 10 and 16 litres.

Advantageously the volume of the first air-bag is approximately 12 litres.

Conveniently the volume of the second air-bag is between 5 and 12 litres.

Advantageously the volume of the second air-bag is approximately 8 litres.

In one embodiment the first air-bag is of generally elongate form and has a first axis, and wherein the second air-bag is of substantially elongate form and has a second axis, the angl of inclination between the said axes b ing

between 30 and 60^{0}, the second air-bag being inclined forwardly relative to the first air-bag.

In a preferred embodiment the air-bag and the gas generator are initially mounted in the back of the seat in a motor vehicle.

In an alternative embodiment the gas generator and the air-bags are initially mounted within the door of the motor vehicle.

Preferably the first and second air-bags are formed as an integral structure from two substantially mirror image areas of fabric that are substantially superimposed, and which have the free edges thereof secured together, means being provided to separate the first air-bag from the second air-bag whilst defining at least one air-flow passage between the first air-bag and the second air-bag.

Conveniently the separating means comprise a further element of fabric between the two said areas, which is secured to the two said areas to form a common wall between parts of each of the two air-bags, the said at least one airflow passage being constituted by one or more relatively small apertures being formed in said further element of fabric.

Conveniently the said mirror image areas of fabric form two parts of a single piece of fabric, the fabric being folded along a fold line substantially superimposed on the line of symmetry between the two mirror image areas to bring the areas into substantial superimposition.

According to another aspect of this invention there is provided a method of making an air-bag structure for use

in a safety arrangement, said method comprising the steps of taking two areas of fabric shaped to be substantially mirror images of each other, taking a further element of fabric, which has one or more small apertures therein, stitching the opposed edges of the further element respectively to said two areas, and subsequently superimposing the two areas and providing peripheral stitching which secures together the adjacent free edges of the superimposed areas to form an air-bag structure comprising a first air-bag and a second air-bag, the further element of fabric comprising a common wall that forms part of each of the two air-bags.

Preferably the two areas form parts of a single piece of fabric, there being a line of symmetry between the areas, the method comprising the step of folding the single piece of fabric along a fold line coincident with the line of symmetry to superimpose said two areas.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which

FIGURE 1 is a diagrammatic view of a seat of a motor vehicle provided with a safety arrangement in accordance with the invention with an air-bag structure that forms part of the safety arrangement in the fully inflated state,

FIGURE 2 is a front view of a motor vehicle provided with a seat mounted air-bag arrangement as shown in Figure 1 shortly after a side impact occurs,

FIGURE 3 is a view corresponding to Figure 2 illustrating the vehicle at a later moment during the side impact,

FIGURE 4 is a view corresponding to Figure 2 but illustrating a modified embodiment of the invention,

FIGURE 5 is a perspective view of an element of fabric intended for use in forming an alternative air-bag structure comprising part of a safety arrangement in accordance with the invention,

FIGURE 6 is a sectional view taken on the line VI-VI of Figure 7 of an air-bag structure fabricated from an element as shown in Figure 5, and

FIGURE 7 is a sectional view taken on the line VII-VII of Figure 6.

Referring initially to Figure 1, a vehicle seat 1 is illustrated. Mounted within a side part of the back 2 of the seat is a safety arrangement, in the form of air-bag arrangement incorporating an air-bag structure which will now be described. The air-bag structure is usually in the uninflated form and retained within an appropriate recess in the side of the seat but, for the sake of clarity of understanding of the invention, the air-bag structure is illustrated in the fully inflated state.

Contained within the recess in the side of the seat is the air-bag arrangement comprising a gas generator 3 which is connected by electric (or non-electric pyrotechnic) leads 4 to an appropriate sensor adapted to respond to a side impact. The gas generator 3 is connected to a cylindrical diffuser 5 of conventional form which is

located within a first air-bag 6 which forms part of the air-bag structure. The first air-bag 6, when inflated, is intended to be located between the torso of an occupant of the motor vehicle and the side door of the motor vehicle. The air-bag 6 may have an internal volume, when fully inflated, of between 10 and 16 litres, the preferred volume being approximately 12 litres.

The air-bag 6 has an upper wall 7 which has formed in it at least one a relatively small airflow passage constituted by an aperture 8 (or a plurality of apertures) which may have a cross-section (or a total combined cross-section) of approximately 500 mm^2. The aperture (or apertures) 8 leads to a second air-bag 9 which is connected to the first air-bag 6 and which shares the wall 7. The second air-bag 9 thus also forms part of the air-bag structure. The wall 7 is thus common to both air-bags 6 and 9, and has an area which is greater than the area of the aperture (or apertures) 8.

It is to be observed that the air-bag 9 is generally of elongate form and the axis 10 of the air-bag 9 is inclined forwardly relative to the axis 11 of the air-bag 6, which is also of generally elongate form, the angle of inclination, α, being approximately 45^0.

The volume of the second air-bag 9 is approximately 8 litres.

The combination of the first and second air-bag may, or may not, be vented to the atmosphere. Thus, there may be no venting aperture in the exterior envelope of the air-bags. Alternatively, there may be one or more venting apertures. Preferably the venting apertur or apertures vent only the second air-bag to the atmosphere.

Referring now to Figure 2 of the accompanying drawings, if a vehicle in which the described air-bag arrangement is provided is involved in a side impact with another vehicle 20, the other vehicle 20 may impact on the door 21 of the vehicle in which the safety arrangement is provided. An appropriate sensor, of conventional form, will sense the impact and activate the gas generator 3. Gas will pass from the gas generator 3 through the diffuser 5 into the first air-bag 6.

Figure 2 illustrates the situation that exists approximately 8 ms after the gas generator has been activated. The first air-bag 6 is substantially fully inflated, thus providing protection for the torso of the occupant of the vehicle, but the smaller air-bag 9 is substantially uninflated. The inflation of the bag 6 may physically push the torso of the occupant of the motor vehicle away from the door 21.

As the side impact continues to develop, either the torso of the occupant of the vehicle may move towards the door 21, or the door 21 may move inwardly further towards the torso of the occupant of the vehicle. In either event, the first air-bag 6 will be compressed between the door 21 and the torso of the occupant of the vehicle. This will cause the second air-bag 9 to inflate with air passing from the first air-bag 6 to the second air-bag 9 through the aperture (or apertures 8). The second air-bag will then occupy a position, as shown in Figure 3, between the head of the occupant of the vehicle and the door 21. Figure 3 illustrates this situation that may exist 20 ms after the gas generator has been activated in a typical side impact where the vehicle 20 was initially travelling at a speed of 50 kmph relative to the vehicle provided with the described safety arrangement.

Consequently, in a side impact, the described arrangement provides protection for the torso of the occupant of the vehicle during the initial stages of the impact and subsequently protection for the head of the occupant of the vehicle. It is to be appreciated that it is the torso of the occupant of the vehicle that is closest to the point of impact and requires protection first, the head of the person only requiring protection either when the door 21 has moved a sufficient distance to impact the head, or when the head has moved a sufficient distance to impact with the door.

Referring now to Figure 4, a modified embodiment of the invention is illustrated in which the air-bag is not initially mounted in the side of the seat 1 of the motor vehicle, but instead is mounted within the door 21. Figure 4 illustrates a cylindrical gas generator with integral diffuser 30 and shows electric leads 31 leading to an appropriate sensor. The first bag 6 is shown in the inflated form and the second bag 9 is shown in the uninflated form. Thus Figure 4 is broadly equivalent to Figure 2, but illustrating a modified embodiment of the invention.

Referring to Figures 5 to 7, an element of fabric from which an integral air-bag structure, comprising first and second air-bags, is fabricated, and the resultant integral air-bag structure is illustrated.

The element of fabric 40 illustrated in Figure 5 comprises two areas 41,42 which are shaped to be substantially mirror images of each other about a line of symmetry 43.

The line of symmetry 43, as will be described hereinafter, forms a fold line.

Located substantially at the mid point of the fold line is an opening 44, the outer periphery of which is reinforced 45.

The areas 41 and 42 each comprise a substantially rectangular portion adjacent the line of symmetry 43, each area having an outwardly projecting arm 46,47 adjacent the top edge thereof. A small aperture 48 with peripheral reinforcing 48 is formed in the arm 49.

The element of fabric 40 may be folded and stitched, together with another element, as will now be described, to form a composite air-bag comprising a first air-bag and a second air-bag.

Referring now to Figure 6 and 7, the element 40 as shown in Figure 5 is folded along the line of symmetry 43, which then forms a fold line. As the element is folded an insert 50 of fabric is located between the two areas 41,42 extending substantially across the top of the rectangular portion of each of the areas 41,42. The opposed edges of the insert 50 are respectively stitched, by stitching 51 and 52, to the areas 41 and 42. A plurality of small apertures 53,54, having a total cross-sectional area of between 200 and 800 mm^2 are provided within the insert 50. The folding process is then completed so that the areas 41,42 are superimposed.

Subsequently peripheral stitching 55 is provided which secures together the adjacent free edges of the areas 41,42. Thus the stitching extends around the ntire

periphery of the superimposed areas 41,42 apart from the region occupied by the line of symmetry or fold line 43.

It is important that the stitching 51,52 is effected before the stitching 55, to ensure that the operator can have free access to both sides of the areas 41 and 42 whilst effecting the stitching 51 and 52.

It is to be appreciated that when the fabric elements 40 and 50 have been inter-connected in the manner described above, effectively the elements of fabric form a composite air-bag. The aperture 45 may be connected to a gas generator. The part of the composite air-bag below the insert 50 forms a first inflatable air-bag 56 adapted to be inflated when gas from a gas generator passes through the aperture 45. Gas from the air-bag 55 may then pass through the apertures 53,54 into a second air-bag 57. The second air-bag 57 in this embodiment is provided with a small vent aperture 47, but it is to be appreciated that in other embodiments of the invention no vent aperture is provided.

The embodiment of Figures 5 to 7 may be further modified by omitting the insert 50. A line of stitching equivalent to the stitching 51 may be provided inter-connecting the areas 41 and 42, with one or more small gaps being left in the stitching to define airflow passages leading from the lower air-bag 56 to the upper air-bag 57. The stitching thus serves to separate the first air-bag from the second air-bag whilst defining at least one airflow passage between the first air-bag and the second air-bag.

CLAIMS:

1. A safety arrangement in a motor vehicle, the safety arrangement comprising a gas generator adapted to be activated in response to a side impact, the gas generator being adapted to supply gas to a first air-bag, the first air-bag, when inflated, being positioned and adapted to be located between a side of the motor vehicle and the torso of an occupant of the motor vehicle, a second air-bag being connected to the first air-bag and communicating with the interior of the first air-bag by means of one or more relatively small airflow passages, the second air-bag being adapted to be inflated by gas from the first air-bag, the second air-bag, when inflated, being adapted to be located between the head of an occupant of a motor vehicle and the side of the vehicle.

2. A safety arrangement according to Claim 1 wherein the first and second air-bag are not vented to the atmosphere.

3. A safety arrangement according to Claim 1 wherein the combination of the first and second air-bag are vented to the atmosphere.

4. A safety arrangement according to Claim 3 wherein only the second air-bag is vented to the atmosphere.

5. A safety arrangement according to any one of the preceding Claims wherein a common wall forms part of each of the two air-bags, the said one or more airflow passages being constituted by one or more apertures formed in the

common wall, the common wall being larger than the aperture or apertures.

6. A safety arrangement according to any one of Claims 1 to 5 wherein the said one or more airflow passages have a total cross-section of between 200 and 800 mm^2.

7. A safety arrangement according to Claim 6 wherein the one or more airflow passages have a total cross-section of approximately 500 mm^2.

8. A safety arrangement according to any one of the proceeding Claims wherein the volume of the first air-bag is between 10 and 16 litres.

9. A safety arrangement according to Claim 8 wherein the volume of the first air-bag is approximately 12 litres.

10. A safety arrangement according to any one of the preceding Claims wherein the volume of the second air-bag is between 5 and 12 litres.

11. A safety arrangement according to Claim 10 wherein the volume of the second air-bag is approximately 8 litres.

12. A safety arrangement according to any one of the preceding Claims wherein the first air-bag is of generally elongate form and has a first axis, and wherein the second air-bag is of substantially elongate form and has a second axis, the angle of inclination between the said axes being between 30 and 60^0, the second air-bag being inclined forwardly relative to the first air-bag.

13. A safety arrangement according to any one of the preceding Claims wherein the air-bag and the gas generator

are initially mounted in the back of the seat in a motor vehicle.

14. A safety arrangement according to any one of Claims 1 to 12 wherein the gas generator and the air-bags are initially mounted within the door of the motor vehicle.

15. A safety arrangement according to any one of the preceding Claims wherein the first and second air-bags are formed as an integral structure from two substantially mirror image areas of fabric that are substantially superimposed, and which have the free edges thereof secured together, means being provided to separate the first air-bag from the second air-bag whilst defining at least one airflow passage between the first air-bag and the second air-bag.

16. A safety arrangement according to Claim 15 wherein the separating means comprise a further element of fabric between the two said areas, which is secured to the two said areas to form a common wall between parts of each of the two air-bags, the said at least one airflow passage being constituted by one or more relatively small apertures formed in said further element of fabric.

17. A safety arrangement according to Claim 15 or 16 wherein the said mirror image areas of fabric form two parts of a single piece of fabric, the fabric being folded along a fold line substantially superimposed on the line of symmetry between the two mirror image areas to bring the areas into substantial superimposition.

18. A method of making an air-bag structure for use in a safety arrangement, said method comprising the steps of taking two areas of fabric shaped to b substantially

mirror images of each other, taking a further element of fabric, which has one or more small apertures therein, stitching the opposed edges of the further element respectively to said two areas, and subsequently superimposing the two areas and providing peripheral stitching which secures together the adjacent free edges of the superimposed areas to form an air-bag structure comprising a first air-bag and a second air-bag, the further element of fabric comprising a common wall that forms part of each of the two air-bag.

19. A method according to Claim 18 wherein the two areas form part of a single piece of fabric, there being a line of symmetry between the areas, the method comprising the step of folding the single piece of fabric along a fold line coincident with the line of symmetry to superimpose said two areas.

20. A safety arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings.

21. A safety arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings as modified by Figure 4.

22. A safety arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings as modified by Figures 5 to 7.

23. A method of making an air-bag structure substantially as herein described with reference to Figures 5 and 7 of th accompanying drawings.

24. Any novel feature or combination of features disclosed herein.

The Patent Office

Application No: GB 9505932.5 **Examiner:** Pat Everett
Claims searched: 1-17 **Date of search:** 7 June 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): B7B (BSB)

Int Cl (Ed.6): B60R 21/22, 21/24

Other: Online: EDOC WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB2266075A	Autoliv (note head and torso bags in figure 3)	1
Y	GB1326671	General Motors (note figure 1, especially orifice 50 between head and torso bags 20,22)	1
Y	EP0593172A	Morton International	1
Y	EP0523704A	Toyota (note bag 70 which protects head and torso, top part unfolds after bottom part)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.